School of Education

Certificate

I hereby declare that the short synopsis **"An Experimental Study of Blended learning approach in the context of problem-solving ability in Chemistry among secondary students"** being submitted in partial fulfilment of the requirement for the degree of Doctor of Philosophy in **Education** under **school of Education** of U.P. Rajarshi Tandon Open University, Prayagraj during the academic year 2023.

It is a Bonafide record of original work carried out under the supervision of Prof. **P.K. ASTALIN** and has not been submitted in full or part to any other university or institute for a degree or diploma. Further, it is certified that the short synopsis is plagiarism-free and the repot has been submitted.

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"An Experimental study of blended learning approach in the context of problem-solving ability in Chemistry among secondary students"

Submitted in partial fulfilment of the requirement of the degree of

DOCTOR OF PHILOSOPHY In Education

to

U.P. Rajarshi Tandon Open University, Prayagraj

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Abstract: Blended learning approach is a mixture of face to face i.e traditional learning and online activities and integration of synchronous and asynchronous tools which strengthen the learning process. This Experimental research aims to study the effectiveness of blended learning approach in the context of problem solving abilities in chemistry among secondary school students. A module and a questionnaire will be developed for the implementation of this research in the classroom. In present study, t-test, one way ANOVA, Two way ANOVA and Analysis of covariance will be used for the data analysis. This research is limited to certain geographical area, time frame and Educational level.

Keywords: Blended Learning, Problem-solving ability, Secondary Students, Critical thinking, Analytical Reasoning, Module.

1. Introduction:

Methods of Instruction of Education changes from time to time in history of Education. In the context of India, during Vedic age teaching-learning process was mainly on oral which changes in to debate and discussion form in Buddhism Era. New type of instructional method was seen at the time of Britishers in the form of face-to-face teachin-learning process in classrooms. Now since the early past decade, use of computer revolutionized the education whose use in the education brings use of internet with it and finally it gave birth to blended learning.

If we consider the current situation, COVID-19 has caused a significant shift in the way education is transacted, and recent years have seen a backlash against the educational system. The entire teaching learning system has transitioned to an online format at this time. To establish a flexible learning environment, Blended learning strategy incorporates both synchronous and asynchronous learning techniques. It is important for students to continue their education after traditional class hours, whether through individual study or online discussion.

Blended learning approach is a mixture of face to face and online activities and integration of synchronous and asynchronous tools which strengthen the learning process.

Alfred B. Buao, Germelyn, et al (2022) suggest - To provide education up to remote areas, blended learning works as innovative pedagogical approach. Major challenges of education like rapid expansion of knowledge, reach of education up to remote areas and availability of plenty of lectures can be adressed by it. Further, blended learning approach significantly contributes to increase literacy rates and reduced illiteracy.

According to Freihat (2004), Blended learning is like a mixtape conventional and modern online learning. It's when teachers use more than just one way to help students learn things.

Al-Rimawi in 2016 says Blended learning is about bringing together old-school way of learning and using computers or the internet to make learning even better.

"Blended learning combines different ways of teaching to make learning better. It combines the traditional classroom teaching with newer online ways of learning. Earlier these ways were used seperately according to the need of the students. But now, due to better technology and teacher's plan lessons, blended learning can give more productive results.

It's easy to set goals for what students should learn, understanding how different students learn best, and using both online and face-to-face teaching to make learning balanced and good. The important thing in this approach is that teacher should know how it works and for which it is suitable. (Osguthorpe and Graham,2003)."

Ismail, (2009) defines - " The Blended learning is considered to be applied when teachers adopt new technology to mix two kinds of teaching- learning process : the traditional classroom way and the way people learn from a distance. It's about teachers using modern techology and new tools for the delivery of content. These tools don't have to be super fancy or special, but they link to things to learn and do. It's basically teachers using both regular method and new technology to help students learn effectively."

Hassan (2010) thinks blended learning is a way of learning which helps students to reach their learning goals. It mixes the old-style learning in classrooms with e-learning, which is learning using computers or the internet, both in synchronous and asynchronous way. It's like combining regular face to face class with using computers or internet to learn more."

Salamah, (2005) explains special features of blended learning . It's about having face-to-face interaction between students and teachers, making it convenient for the teaching learning process. Due to its efficient nature it is useful to save money and also it is good for making people more social and friendly while learning. Blended learning approach is also helpful because it can fit everyone's needs and how they learn. It mixes different ways of checking how well you've learned things, and it's good at using both real and online stuff for learning.

It helps teachers use cool technology to teach better, and it's useful for teaching people on the job or while they're studying without needing lots of resources. Most importantly, it helps you practice and keep using what you've learned regularly, making it a natural part of what you do."

2. Literature Review:

A study by Maccoun, Hussein Salem 2016 was conducted to see how blended learning affects fifth grade students to remember concepts of biology. They randomly selected a high school and created two groups in Baghdad. One group used blended learning, which mixes different methods of instruction, while the other group learned in the conventional way of instruction. Each group created with 30 students. They prepare a test with 30 questions to test the students learning outcomes and it was ensured that test is up to the level of that class students.The results showed that the group which was exposed to blended learning approach did better in the test and remembered more concepts compared to the group which learned in the conventional way."

Vijayakumari G. & Nachimuthu K. (2009) mentioned in their work, how online learning changed the way of methods of instructions in camparison to old way of teaching learning process. With the use of internet, it is easy to access education without spending much hard work to have it. The major challenges of this method is that, it needs better technology, knowledgeble and skilled instructor and enough finance. These challenges becomes more difficult when it tries to reach across rural areas.

Bakia M., Shear L., et al. (2012) outlined in their study that giving students more exposure to learn is good, and online education make sure the availability of education up to the remote areas where physical infrastructure is not suitable for the conventional methods.

Aibek E. (2011) in his work explained that online courses tries to make learning better and improve the learning of students. The changes in way of instruction creates new opportunities for educators. The use of internet provide opportunity to use new different tools, like videos and browsing features, to engage students in learning. New tools in the way to education make learning more interactive. Search engines ensures finding information super easy for students with just a click.

Irina (2011) mentioned about initiatives taken by the government to have more online learning in the whole country. In 2009, the Ministry of Human Resource Development(HRD), GoI, started the National Mission on Education through ICT. HRD and UGC also started a big project called "Shodh Ganga" for researchers to access theses, run by the government through INFLIBNET.

Yongchul Y. &Wongyu L. (2007) explained that online assessments of the learning process is convenient in camparision to the one by one assessment. It saves much time and energy of educators and students which can be used in other learning activities.

3. Description of Broad Area

Research Question:

- What impact does the blended learning approach have on the problem-solving ability of secondary students in chemistry?
- How does the integration of digital tools in a blended learning environment affect students' engagement and understanding of chemistry concepts?
- What are the differences in learning outcomes between students who participate in a blended learning approach-based chemistry class versus traditional classroom setting?
- What role do teacher-led instructions and peer collaborations play in a blended learning setup for teaching problem solving in chemistry?

Statements of Problems: An experimental study of blended learning approach in the context of problem-solving ability in chemistry among secondary students.

Operational Definition:

- **Blended Learning Approach:** A pedagogical approach that combines traditional face-to-face classroom instruction with online learning elements but not limited to flipped classroom methodologies, and collaborative online platforms. This approach involves a structured integration of digital and traditional learning experiences to enhance chemistry education.

- **Problem-Solving Abilities:** The cognitive abilities and strategies used by students to identify, analyse, and solve complex problems within the context of chemistry subject among secondary students.
- **Critical thinking:** Critical thinking refers to the cognitive process of actively and skilfully conceptualizing, and evaluating information gathered from observation, experience, reflection, reasoning, or communication. It involves the ability to objectively assess evidence, deduce implications, and form well-reasoned judgments or conclusions.

Analytical Reasoning: It involves breaking down complex problems or situations into their component parts, analysing the underlying principles or structures, and synthesizing relevant information to draw logical conclusions or solve problems effectively.

- **Module:** A module is a structured educational unit or component designed to facilitate learning and instruction on a specific topic or subject matter. It typically consists of organized content, instructional materials, learning objectives, and activities that are integrated to achieve specific educational outcomes.

4. Objectives of the Study:

- To prepare a module on blended learning approach for chemistry among secondary students.
- To prepare problem solving ability questionnaire for chemistry among secondary students.
- To study the effectiveness of Blended learning approach on problem-solving ability among secondary students.
- To measure the effect of gender, blended learning approach and their interaction on problem-solving abilities among secondary students.
- To compare adjusted mean scores of problem-solving ability of secondary school students in chemistry by using blended learning approach and traditional method by considering their pre problem solving skills and intelligence as covariates.

Research Hypotheses:

- The module based on blended learning approach for chemistry will be prepared to enrich problem-solving ability among secondary school students.
- The questionnaire based on problem solving ability for chemistry among secondary school students to enrich problem solving ability.
- There is significant effect of blended learning approach on specific problem-solving ability among secondary students.
- There is significant effect of gender, blended learning approach and their interaction on problem-solving ability among secondary students.

- There is significant difference between adjusted mean scores of problem-solving ability of secondary students in chemistry by using blended learning pre problem solving ability and intelligence as covariates.

5. Research Methodology:

This research will employ a quasi-experimental method, utilizing quantitative measures and qualitative data collection techniques. Quantitative analysis will involve comparing mean scores of problem-solving ability between traditional and blended learning environments. There will be two group – Experimental and control group.
In Experimental group both traditional method and Blended learning approach will employ whereas in control group only traditional method will employ.

- **Research Procedure –**
- First, a school will be selected in which research can be do.
- Getting a letter from the principle to conduct research.
- Formation of two groups i.e. experimental group and control group in which 25 students will be included.
- Conduct pre-tests to establish a baseline for problem-solving ability among all participating students.
- Design and implement blended learning strategies for the experimental group.
- Ensure the traditional learning group receives conventional face-to-face instruction without the blended components.
- Monitor the progress of both groups throughout the learning period.
- Collect data on problem-solving abilities (e.g., assessments, problem-solving tasks) periodically during the study.
- Administer post-tests to evaluate problem-solving ability after the completion of the blended learning intervention.
- Analyse the collected data using statistical methods to compare the mean problem-solving abilities between the experimental and control groups.
- Use appropriate statistical tools to determine the significance of differences observed.
- Gather qualitative feedback from students and educators regarding their experiences with blended learning.

- Analyse qualitative data to understand perspectives, challenges, and perceived effectiveness of the blended learning approach.

Variable of the Study-

- **Independent Variables** - Blended learning approach.
- **Dependent Variables:** problem- solving ability.
- **Background variables**: Gender and Intelligence

Population, Sample and Sampling technique: In the present study the population contains secondary school students of CBSE Board in Prayagraj city. The present study will include 50 students who are enrolled in class 11th of a secondary school of CBSE in Prayagraj city of Uttar Pradesh. Sampling will be done through simple random sampling technique.

Research Tools –

- Blended learning approach-based module will be developed by Researcher.
- Problem solving ability questionnaire will be developed by Researcher.

Statistical techniques to be used – For the data analysis of present study, t-test, One way ANOVA, two way ANOVA and Analysis of covariance will be used.

Procedure of data collection and statistical Analysis technique –

Present study will go through in following phases-

Phase 1. Construction of blended learning-based module.

Phase 2. Implementation of blended learning-based module.

Phase 3. Construction and administration of problem-solving ability questionnaire.

Phase 4. Evaluation of objectives and testing of hypotheses.

Delimitation of the Study- Here are some delimitations specific to a study on blended learning approach in chemistry among secondary school students.

Geographical Limitation: The study will take place at Prayagraj city of Uttar Pradesh. It will not cover a nationwide or global sample, limiting the generalizability of findings to the selected area.

Timeframe: The research will be conducted within a specified academic year or semester. It may not encompass long-term effects or changes that might occur over multiple academic years.

Educational Level: The study is limited to class 11th of secondary students studying chemistry in CBSE board only. It does not include students from other grades or subjects, thereby narrowing the scope to this specific educational level and subject area.

Teaching Methods: The comparison will be taking place between traditional classroom teaching and blended learning approaches. Other educational methodologies or interventions will not be considered in this study.

Sample Size: Due to resource constraints, the study might have a specific sample size limitation, potentially limiting the generalizability of findings to a larger population.

6. Expected Outcomes:

This research is expected to find the benefits of use of blended learning technology along with the traditional classroom learning. The focus of this research is to know the improvement in problem-solving ability of secondary school students in chemistry, so it is expected that those students who exposed to the blended learning approach perform significantly higher problem-solving abilities than traditional classroom method.

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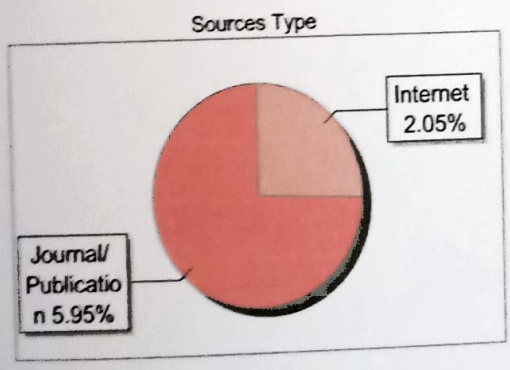

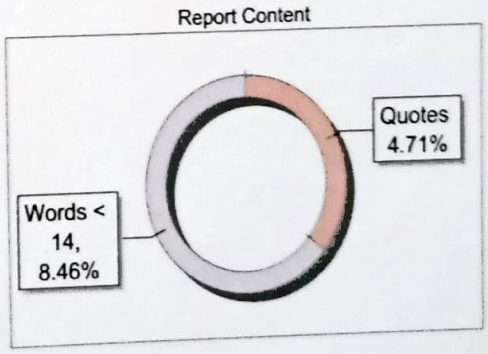

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